swept over the face of the mountain, driving the rain in almost horizontal sheets along the surface. From time to time mists floated over the mountain, and it was bitterly cold.

Iceland a Meteorological Station.—If Iceland were connected with the Faëroe Islands, and with the north of Scotland by telegraph, there can be no doubt that it would form a valuable meteorological station, although from the various disturbing influences the effect of which would be comparatively local, such as the jokulls and the various local currents, such a station would be less valuable than would be afforded by a vessel moored 600 or 800 miles out in the Atlantic between Ireland and Newfoundland, and in telegraphic communication with the central office in London.

Drift Wood of Iceland.—Great quantities of drift wood are thrown upon the southern coast of Iceland. It is said to be chiefly fir, and it is asserted by some to come from Siberia by an arctic current, and by others from America by the Gulf Stream. We noticed that the coast between Grindavik Staðr and Cape Reykjanes was far more thickly strewn with drift wood than the coast more to the east in the neighbourhood of Eyrarbakki. As the Gulf Stream impinges on the south-western peninsula, it would seem that it must therefore be the chief source of the drift wood. The trees that we saw were torn up by the roots, and they were completely blanched, and in many cases riddled with holes by some species of borer. A portion of the skeleton of a large whale was visible on the shore near Grindavik.

Improvements in Iceland.—During the year which has elapsed since we last visited Iceland, several very marked improvements have been set on foot. In no respect is this more conspicuous than in the case of the roads. A few years ago a writer made the assertion "there are no roads in Iceland." At the present time road-making is making great progress, and many scores of miles of excellent roads exist. Of course we mean such roads as alone are possible, without great expenditure of money and labour, in a country which is one vast volcano. Driving roads are impossible, but excellent pony roads are being constructed, and will greatly facilitate despatch of business and intercommunication. The first bridge in Iceland is about to be commenced. It will cross the Olfusà, and materially help to establish a better communication between the east and the west. A second bridge is to be thrown across the Thjorsa. The first lighthouse in the island was erected a year ago, and the light-dues paid by ships at the port of Reykjavik have already almost paid for its construction. There is some talk of founding a school of farming at Moðrudalr in the north-west, and a law school in Reykjavik, where a divinity school and a medical school already exist. In Reykjavik new houses are being built; there is a proposition on foot to build an hotel, and a new house for the Althing, which now holds its biennial meetings in the Latin school. Hafnafjord and Eyrarbakki are flourishing little ports; Akureyri does a fair trade in shark liver oil, and in ponies; and the Krisuvik sulphur mines appear to be in good working order, and to yield a rich product.

Reykjavik, September 2 G. F. RODWELL

ON HARMONIC RATIOS IN THE SPECTRA OF GASES

PROF. G. JOHNSTONE STONEY has given in the April number of the *Phil. Mag.* for 1871 some remarkable ratios of the wave-lengths of three of the hydrogen lines. Prof. Soret and Mr. Lecoq de Boisbaudran have also given several similar ratios, and I have found at various times a great many. It is, however, impossible to decide, without a thorough discussion, how many of these harmonic ratios may be due to accident. All possible fractions in a given spectrum ought to be calculated, and we could then see, by the theory of probability, whether the coincidences with ratios of comparatively small numbers are more numerous than we ought to expect. I began this work about a year ago. The calculation and discussion of twenty thousand fractions will necessarily take some time. The following simple ratios, however, which I have found in the iron-spectrum, I believe to be worth recording. I may say that I have gone only through the seventh part of that spectrum as yet. The first column in the following table contains the corrected wave-lengths of iron lines as given by Ångström. If these numbers are multiplied by the fractions given in the second column, we obtain the calculated values of other iron lines. The observed values and difference are given in the fourth and fifth columns.

λ	Fraction.	Calculated.	Observed.	Δ
6302·49	8 : 10	5041·99	5041·69	−0·30
6231·64	5 : 6	5193·03	5193·25	+0·21
6192·43	9 : 10	5573·19	5573·37	+0·18
	6 : 7	5307·80	5308·10	+0·30
6137·53	8 : 9	5455·58	5456·36	+0·72
	7 : 8	5370·34	5370·65	+0·31
6066·39	7 : 8	5308·09	5308·10	+0·01
6009·32	8 : 9	5341·62	5341·87	+0·25
	2 : 3	4006·2	4006·0	−0·2
6003·92	7 : 10	4202·74	4202·75	+0·01
	5 : 6	5003·27	5003·52	+0·25

The differences could of course be reduced to one-half by throwing part of them on the possible errors in the observation of the wave-lengths given in the first column. It is to be remarked that the intensities of the iron lines which figure in the above table are as a rule very strong. Thus all but three of the lines have an intensity of over six attached to them in Watts' Index.

The following table contains a set of iron lines, which can be arranged as harmonics of a fundamental vibration whose wave-length is 0·018694765 of a millimetre.

The table is arranged according to the pattern of that given by Prof. Stoney for the hydrogen lines.

Observed wave-lengths in vacuo.	Calculated values.	Differences.
6231·64	$\frac{1}{30}$ × 186947·65 = 6231·59	+ 0·05
5498·28	$\frac{1}{34}$ × 186947·65 = 5498·46	+ 0·18
5193·25	$\frac{1}{36}$ × 186947·65 = 5192·99	+ 0·26
5052·53	$\frac{1}{37}$ × 186947·65 = 5052·64	− 0·11
4919·63	$\frac{1}{38}$ × 186947·65 = 4919·68	− 0·05
4248·08	$\frac{1}{44}$ × 186947·65 = 4248·81	− 0·73
4064·1	$\frac{1}{46}$ × 186947·65 = 4064·1	− 0·0

I have included the forty-fourth harmonic, because Thalén gives 4248·8 for the observed value of the wave-length, which reduces the difference to zero. I must, of course, complete the investigation before I can definitely say in how far all these coincidences may be due to accident. On the whole, as far as I have hitherto gone, the result does not seem to be decisive in favour of such a simple connection between the wave lengths of different lines. The true law of the distribution has not yet, I believe, been found, but harmonic ratios may take a secondary part. ARTHUR SCHUSTER

OUR ASTRONOMICAL COLUMN

PALISA'S COMET.—The following elements of this comet have been calculated by Mr. Hind from the first Pola observation on August 21, one at Leipsic on August 28, and M. Henry's observation at Paris on September 11:—

Perihelion passage, 1879, October 4·2871 G.M.T.

Longitude of perihelion	201 41 52·8	Apparent Eq.
,, ascending node ...	86 54 4·2	August 31.
Inclination	76 57 38·2	
Log. perihelion distance... ...	9·9983406	

Motion—direct.

Positions deduced from these elements for midnight at Greenwich are:—

	Right Ascension.	Declination North.	Log. distance from Earth.	Log. distance from Sun.
	h. m.	° ′		
Oct. 2 ...	14 19·1 ...	22 31 ...	0·2044 ...	9·9985
3 ...	— 23·5 ...	21 30		
4 ...	— 27·9 ...	20 30 ...	0·2072 ...	9·9985
5 ...	— 32·1 ...	19 29		
6 ...	— 36·3 ...	18 28 ...	0·2106 ...	9·9987
7 ...	— 40·4 ...	17 28		
8 ...	— 44·4 ...	16 27 ...	0·2144 ...	9·9995
9 ...	— 48·3 ...	15 27		
10 ...	— 52·2 ...	14 28 ...	0·2187 ...	0·0008
11 ...	— 55·9 ...	13 28		
12 ...	14 59·6 ...	12 30 ...	0·2234 ...	0·0027

On November 4·5 the right ascension is 242° 40′ and the declination 7° 6′ south, the comet setting in London two and a quarter hours after the sun; the intensity of light is then somewhat greater than at discovery, so that observations may be expected till about a month after the perihelion passage.

NEAR APPROACH OF COMETS TO THE EARTH.—Amongst the cases of close approach of comets to our globe there are two in which we are able to fix the actual degree of approximation with certainty, the orbits at the times having been determined with great precision. The first is that of the comet of 1770, treated of by Laplace in the *Mécanique Céleste*. According to Clausen's elaborate investigation, in which the effect of the earth's attraction is included, this comet at 5h. 6m. P.M. Greenwich time on July 1, was distant only 0·01509 of the earth's mean distance from the sun, or 1,390,000 miles, and it is the closest approach of one of these bodies of which we have any certain knowledge. On this evening its apparent diameter, as measured by Messier, was no less than 2½°, or nearly five times the apparent diameter of the moon; at this time the comet was traversing the constellation Draco. The second case is that of Biela's comet at its appearance in 1805. At 9h. P.M. on December 9, just before it descended below the horizon in Europe, and almost at the time of the last observation by Thulis at Marseilles, the comet was distant 0·0366, or about 3,380,000 miles. There can be little doubt that the comets of 568, 1366, 1472, and others passed near the earth, but the elements of their orbits are not determinable within anything like close limits. The first comet of 1743, for which Clausen assigned an elliptical object, was also near to us, but the orbit in this instance is doubtful, and the actual distance in perigee cannot be deduced with precision.

There have been many instances where comets at one or other node have passed much nearer to the *earth's orbit* even than in the case of the comet of 1770, as occurred with Biela's comet in 1839, but the nodal passages have taken place when the earth has been far removed from these points of her path.

BIOLOGICAL NOTES

THE "CHALLENGER" RHIZOPODS.—In the current number of the *Quarterly Journal of Microscopical Science* Mr. H. B. Brady, F.R.S., continues his very interesting preliminary report on the porcellanous and hyaline types of rhizopods met with in the dredged stuff brought home by the *Challenger* Expedition. He very justly abolishes the misleading generic names of *Tri-* and *Quinque-loculina*, agreeing with Prof. Williamson to employ the modified term *Miliolina* for the section. Quoting *Decaisnella*, M-Chalmas, as a synonym of *Dactylopora*, P. and J., he mentions that *D. eruca* occurs in considerable variety of form, but that after the examination of a large number of fresh specimens, he has never seen anything to correspond to the structures figured in M-Chalmas's paper in the *Comptes Rendus*—figures curiously enough reproduced in another portion of the same journal, in which Mr. Brady's paper appears. The species of *Lagena* found supply material, we are told, for five or six crowded plates, its varieties embracing modifications of contour and surface decoration before unknown and most remarkable for their individual beauty. The rare and interesting *Pavonina flabelliformis*, D'Orbig., has been taken at three of the *Challenger* stations; originally described imperfectly by D'Orbigny from a specimen from Madagascar in 1826, it remained unknown until dredged by Dr. E. Perceval Wright in shallow water near the Seychelles. Two excellent figures of it are given. A number of forms of *Globigerina* are described. *Hastigerina*, Wy. T., is referred to *Nonionina*, D'Orbig. The paper closes with some notes on "Pelagic Foraminifera," in which, "while without departing from an attitude of caution in accepting evidence upon a subject so beset with difficulties," the author confesses that he sees no anomaly in the supposition that organisms so simply constituted as this group of protozoa may be equally at home at the surface and at the bottom of the ocean.

THE "CHALLENGER" ECHINI.—Prof. Alexander Agassiz has just published a preliminary report on the echini of the exploring expedition of H.M.S. *Challenger* in the *Proceedings* of the American Academy (vol. xiv. p. 190, June, 1879). It was not Agassiz's intention to publish this preliminary notice, as he hoped to be able to issue the descriptions of the species with his final report on the group; he found himself, however, compelled for the sake of retaining for the material of the *Challenger* expedition the priority of discovery, to notice, however briefly, the magnificent collection of sea-urchins intrusted to his care by Sir Wyville Thomson. In contrasting this collection with those made during the two expeditions of the U.S. steamer *Blake*, Agassiz says that these latter contain some of the most interesting forms obtained by the former, often complementing more or less imperfect *Challenger* material. Among the Cidaridæ, Arbæciadæ, and Diadematidæ, many new species were found, and a new genus allied to Astropyga. Among the Echinothuriæ, a number of new species were dredged. Among the Echinometradæ nothing of importance was collected. Among the Temnopleuridæ excellent series of the species of Salmacis and Temnopleurus were obtained, a Cottaldia, hitherto only known from the chalk, and an exquisite genus Prionechinus, allied to Salmacis. The most interesting feature of the Echinidæ proper, was the occurrence of several northern forms in deep water in the tropics. Not a single new species of Clypeastroids was found, and the number of specimens even was quite small. They do not play any important part in shaping the character of the fauna of deep water, and are, perhaps, the most strictly littoral group of Echini, indicative at least, in the present epoch of comparatively shallow water, inside of the 100-fathom line, and probably giving us a good guide as to the depth of the sea and the nature of the bottom of the cretaceous and tertiary shores, where they occur in such large numbers. One recent species of Catopygus is interesting, as adding another of the cretaceous forms to those still living. By far the most interesting group of Echini is that of the Pourtalesiæ—the species were found in abundance; of Pourtalesia there are six species. In Cystechinus there are three species, *C. Wyvillii* and *C. clypeatus* have quite stout tests, while in *C. vesica* the test is reduced to a mere film, so that even in alcohol the shape of this sea urchin reminds one of the crown of an old felt hat which had seen its best days. The test of all the Pourtalesiæ is quite delicate, the amount of lime-